

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HUM INDUSTRIAL TECHNOLOGY, INC.
Petitioner

v.

AMSTED RAIL COMPANY, INC.
Patent Owner

Case IPR2023-00538
Patent No. 9,365,223

Before JAMES P. CALVE, KEVIN W. CHERRY, and MICHAEL L. WOODS,
Administrative Patent Judges.

**PETITIONER'S OPPOSITION TO PATENT OWNER'S
REVISED MOTION TO AMEND**

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Patent Owner's Revised Motion to Amend (Paper 35 ("Mot.")) should be denied, because each of claims 33–61 is obvious in view of the prior art. Substitute claims 34–58 also lack written description and are invalid under 35 U.S.C. § 112.

I. SUBSTITUTE CLAIMS 34–58 LACK WRITTEN DESCRIPTION

Substitute claims must be supported by the written description of the original application, and may not introduce new subject matter. *See* 35 U.S.C. § 316(d); 37 C.F.R. § 42.121(A)(2)(ii). To satisfy this requirement, “the description must clearly allow persons of ordinary skill in the art to recognize that the inventor invented what is claimed.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (cleaned up). “The written description requirement is particularly important when, as here, claims are added later during prosecution in response to development by others.” *FWP IP ApS v. Biogen MA, Inc.*, 749 F. App'x 969, 974 (Fed. Cir. 2018).

Patent Owner presents a claim chart purporting to show where each individual limitation may be found in the specification. *See* Mot., 6–21. As discussed below, many of the added limitations are not, in fact, disclosed anywhere in the specification. But even if Patent Owner could successfully identify support for each individual limitation, “an amalgam of disclosures plucked selectively from the [original] application” does not satisfy the written description requirement. *Novozymes A/S v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1349 (Fed. Cir. 2013); *accord Ariad Pharms.*, 598 F.3d at 1352 (Fed. Cir. 2010). Rather, the

original application must support each claim “as an integrated whole rather than as a collection of independent limitations.” *Novozymes*, 723 F.3d at 1349. Patent Owner cannot make this showing for substitute claims 34–58.

A. Claims 34 and 42: “mounted to a sidewall of a bearing adapter”

The ’223 Patent is broadly directed to a monitoring system comprising sensing units “mounted on a railcar.” EX1001, (57) Abstract. For example, the specification states broadly that its sensing units can comprise “any type of sensor,” and provides a laundry list of different sensor types. EX1001, 4:52–59.

The ’223 Patent does not specify any particular location on the railcar where the sensing units must be mounted. To the contrary, the specification expressly recognizes that different sensors will require different housing configurations and mounting locations. EX1001, 4:39–42 (“As one of ordinary skill would recognize, the configuration of the motes 10 with respect to the sensor 20 is dependent upon the type of sensor and the type of data desired.”). EX1035, ¶ 18.

Consistent with this disclosure, claim 2 of the ’223 Patent does not require the sensing unit to be mounted at any particular location on the railcar. Proposed substitute claim 34, however, has been amended to require a sensing unit mounted at a *specific* location—namely, on the sidewall of a bearing adapter.

To support this amendment, Patent Owner relies heavily on an embodiment disclosed in Figs. 3 and 3A of the ’223 Patent. But the embodiment of Figs. 3 and

3A is expressly described in the specification as a *temperature* sensing device.

EX1001, 5:31–34. (“As an example, FIGS. 3 and 3A show a temperature sensing mote 10 of the type described above mounted to a bearing adapter...”). The ’223 Patent does not indicate that this embodiment comprises any type of sensor other than a temperature sensor. EX1035, ¶ 20. Indeed, a PHOSITA would understand that many of the listed sensor types (e.g., strain gauges, gyroscopes, reed switches, limit switches) would serve no purpose if mounted on the sidewall of a bearing adapter. *Id.*, ¶ 18. More generally, no other type of sensor is described in the application as suitable for mounting on the sidewall of a bearing adapter. *Id.*

Patent Owner also relies on the table spanning cols. 7–12, which includes two examples that reference an “adapter mounted accelerometer.” But neither example states that the accelerometer is mounted specifically to the *sidewall* of a bearing adapter as expressly required by the claim. EX1035, ¶ 21. A PHOSITA would understand that a bearing adapter has multiple surfaces suitable for mounting sensor devices. *Id.*, ¶ 19. LeFebvre, for example, discloses sensors mounted to “the upper rectangular surface of the bearing adapter.” EX1005, ¶ [0020]. Claim 34, however, expressly requires mounting on the *sidewall*.

Substitute claim 34 is therefore directed to a specific combination of features that are not linked in the specification. The patent includes a general disclosure that a sensor device may be mounted on a railcar, and it includes a specific example of

a *temperature* sensor mounted on the sidewall of a bearing adapter. But it does not disclose what is now claimed, which is *any* type of sensor mounted *specifically* on the sidewall of a bearing adapter. The specification contains no blaze marks directing a PHOSITA to this combination of features. *See Hyatt v. Dudas*, 492 F.3d 1365, 1371 (Fed. Cir. 2007) (upholding a rejection for lack of written description where “each element [was] *individually* described in the specification,” but patent owner failed to “provide support for the *linkage of the claimed elements* creating the embodiment”) (emphasis in original); *Purdue Pharma L.P. v. Faulding Inc.*, 230 F.3d 1320, 1326–1327 (Fed. Cir. 2000) (“one cannot disclose a forest in the original application, and then later pick a tree out of the forest and say here is my invention. In order to satisfy the written description requirement, the blaze marks directing the skilled artisan to that tree must be in the originally filed disclosure”).

**B. Claims 34 and 42: “one or more numeric values derived from the data,”
“one or more numeric values based on the collected data”**

The term “numeric values” does not appear in the specification, and it is unclear how the term corresponds to the original disclosure. EX1035, ¶ 22. In support of this amendment, Patent Owner relies primarily upon the table of example heuristics that spans columns 7-12 of the specification. *See Mot.*, 11–12. Patent Owner’s argument appears to be that a PHOSITA could generalize from the disclosed examples of “heuristics” and conclude that “many implementations” of

“numeric values” are within the scope of the invention. *Id.*

Even if Patent Owner were correct, however, that argument would not satisfy the written description requirement. Written description support “does not extend to subject matter which is not disclosed, but would be obvious over what is expressly disclosed. It extends only to that which is disclosed.” *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571–72 (Fed. Cir. 1997). *See also Ariad Pharms.*, 598 F.3d at 1352 (“a description that merely renders the invention obvious does not satisfy the requirement.”) Specific examples of “heuristics” cannot provide support for a more general concept of “numeric values” that is not disclosed in the application. “One shows that one is ‘in possession’ of *the invention* by describing *the invention*, with all its claimed limitations, not that which makes it obvious.” *Lockwood*, 107 F.3d at 1572 (emphasis in original). Here, there is no description of the “numeric values” that Patent Owner now seeks to claim.

C. Claims 34 and 42: “land-based remote station”/“land-based remote unit”

Claim 42 requires that data collected by the sensor units is processed by ***both*** the CMU (Limitations 42(i)–(k)) ***and*** by the “land-based remote unit” (Limitation 42(l)). Claim 34 requires that a similar analysis is performed by ***at least one*** of the CMU and a “land-based remote station.” Neither of these combinations is supported by the specification. While the specification discloses that heuristics “may be performed by ***either*** mobile base station 42 ***or*** land-based based station

44.” EX1001, 11:40–42 (emphasis added), it does not disclose any embodiment wherein *both* the CMU *and* a “land-based remote unit” perform the claimed steps as required by claim 42 and as expressly encompassed by claim 34. EX1035, ¶ 23.

D. Claim 34: “a housing comprising a non-flexible material that is resistant to environmental damage”

The specification of the ’223 Patent does not include the term “non-flexible material.” Patent Owner cites a statement in the specification that the housing may be “composed of a hard plastic resistant to environmental damage, such as a UV rated polymer, e.g., a polycarbonate/ABS blend.” EX1001, 4:5–10. Claim 34, however, is not limited to the disclosed UV rated polymers. Instead, it claims a broad genus of materials that are not described in the specification. EX1035, ¶ 24.

E. Dependent Claims 35–41 and 43–58

Claims 35–41 and 43–58 lack written description for at least the same reasons as the independent claims from which they depend. Claims 45, 46, and 48 also lack written description for the additional reasons discussed below.

1. Claims 45 and 46

Independent claim 42 requires, *inter alia*, “one or more sensor units mounted on the sidewall of a bearing adapter.” Claim 45 is dependent upon claim 42, and additionally requires that the sensor comprises “a vibration sensor or accelerometer configured to sample dynamic vibration data.” Claim 46 depends from claim 45 and therefore includes the same limitations. As discussed above, the specification

only discloses a single embodiment with a *temperature* sensor mounted to the sidewall of a bearing adapter. *See* Section I.A, *supra*. Claims 45 and 46 are directed to a specific combination of features—a sensor unit comprising a *vibration sensor or accelerometer* mounted to the *sidewall* of a bearing adapter—that is disclosed nowhere in the specification of the '223 Patent. EX1035, ¶ 25.

2. Claim 48

Claim 48 requires “comparing the *one or more numeric values* with a *plurality of defined parameter value ranges associated with the bearing*.” Neither of these bolded terms is used in the specification, and it is unclear how each term corresponds to the language used in the original disclosure. EX1030, ¶ 26.

II. SUBSTITUTE CLAIMS 34–58 ARE INVALID UNDER 35 U.S.C. § 112

A. Indefiniteness

1. Claims 34 and 42: “one or more numeric values derived from the data,” “one or more numeric values based on the collected data”

See the discussion of the same terms with respect to written description in Section I.B, *supra*. As discussed above, this term is not used in the specification, and it is unclear how it relates to the disclosed embodiments. EX1030, ¶ 28.

2. Claim 34: “a non-flexible material that is resistant to environmental damage”

See the discussion of the same terms with respect to written description in Section I.D, *supra*. The term “non-flexible material” is not used, much less defined, in the specification. The specification does not define how “non-flexible”

a material must be to satisfy this limitation, or under what conditions the flexibility should be tested. EX1035, ¶ 29. The specification also fails to define “environmental damage” or how “resistant” a material must be to that type of damage. EX1035, ¶ 30. As a result, a PHOSITA cannot determine with reasonable certainty which materials fall within the scope of this limitation. EX1035, ¶ 31.

3. Dependent Claims 35–41 and 43–58

Claims 35–41 and 43–58 are indefinite for at least the same reasons as the independent claims from which they depend, as discussed in detail above.

B. Enablement

1. Claim 34: “correlate one or more numeric values derived from the data to the condition of the bearing,” “determine a severity of the condition of the bearing”

Claim 34 requires collecting temperature data from a sensor mounted on the *sidewall of a bearing adapter*, and *correlating* “numeric values derived from the data” with the condition of a *bearing*. The evidence of record indicates that a team of academic researchers at UTRGV worked diligently for several years to develop a set of temperature correlations for use with the monitoring system claimed in the ’223 Patent. *See* EX2013 at ¶ 9 (work began “in the 2008 and 2009 timeframe”); ¶ 49 (referencing May 18, 2011 call regarding ongoing “node temperature calibration and data analysis”); ¶ 52 (“by at least August 2, 2011, we believed the condition monitoring system would work”). These temperature correlations are not

disclosed in the '223 Patent, and the specification does not enable a PHOSITA to implement the required correlations without undue experimentation. EX1035, ¶ 32.

2. Claim 42: “correlating one or more numeric values derived from the data to the condition of the bearing,” “determining a severity of the condition of the bearing”

As discussed above, the specification of the '223 Patent is primarily directed to monitoring *temperature*. See Section I.A, *supra*. Claim 42, however, broadly encompasses monitoring *any* “operating parameter” of a railcar. Claim 42 is not limited to a system for correlating any particular type of measurement (e.g., temperature) with the condition of a bearing; to the contrary, claim 42 broadly encompasses using *any possible heuristic* to correlate *any possible characteristic* of a wheel bearing with the condition of the bearing. The '223 Patent does not enable a PHOSITA to practice the full scope of this claim.

As a concrete example, the '223 Patent does not provide any teaching or examples that would enable methods of monitoring *acceleration* as required by dependent claims 45 and 46. EX1035, ¶¶ 33–35. As an independent claim, claim 42 is *at least* as broad as its dependent claims—and in this case, is substantially broader than non-enabled dependent claims 45 and 46. *Alcon Rsch., Ltd. v. Apotex Inc.*, 687 F.3d 1362, 1367 (Fed. Cir. 2012) (“It is axiomatic that a dependent claim cannot be broader than the claim from which it depends.”); *Intamin Ltd. v. Magnetar Techs., Corp.*, 483 F.3d 1328, 1335 (Fed. Cir. 2007). Claim 42 therefore

lacks enablement for at least the same reasons as dependent claims 45 and 46. *See ABS Glob., Inc. v. Inguran, LLC*, 914 F.3d 1054, 1072–73 (7th Cir. 2019) (“The Federal Circuit has indicated that for purposes of enablement, independent and dependent claims must live or die together.” (citing *Alcon*, 687 F.3d at 1368.))

3. Dependent Claims 35–41 and 43–58

Claims 35–41 and 43–58 lack enablement for at least the same reasons as the independent claims from which they depend, as discussed in detail above.

III. SUBSTITUTE CLAIMS 33-61 ARE INVALID UNDER 35 U.S.C. § 103

The Motion should be denied pursuant to 37 C.F.R. §42.121(d)(2) because the claims are invalid as obvious under 35 U.S.C. § 103. Specifically, the subject matter of claims 33–61 would have been obvious under the following grounds.

Ground	References	Claims
1	Armitage in view of LeFebvre, Barone, Moretti, and Brandmeier	34–58
2	LeFebvre in view of Armitage, Barone, Moretti, and Brandmeier	34–58
3	Armitage in view of LeFebvre, Denny, Provasnik, and Culbertson	33, 59–61
4	LeFebvre in view of Denny, Provasnik, and Culbertson	33, 59–61

A. Grounds 1 and 2: Claims 34–58

A PHOSITA would have found it obvious to combine the disclosures of Armitage, LeFebvre, Barone, and Moretti. All four references describe systems for wirelessly monitoring railcars, and utilize nearly identical components that

function in a similar way. *See* EX1005, (57) Abstract; EX1006, (57) Abstract; EX1007, (57) Abstract; EX1028, (57) Abstract. Specifically, each reference discloses a system that utilizes a plurality of sensors to monitor the wheel bearings on a railcar, wherein the sensors communicate with a control unit located on the railcar. *Id.* Each reference discloses that collected data is analyzed to determine, for example, if bearing failure is approaching or imminent. EX1005, ¶¶ [0058]–[0059]; EX1006, ¶¶ [0013]–[0015], [0025]; EX1007, ¶¶ [0201]–[0220]; EX1028, 3:57–62. And each reference discloses that an alarm should be raised when a failure condition is detected. EX1005, ¶¶ [0055]–[0056], [0095]; EX1006, ¶¶ [0042]–[0043]; EX1007, ¶ [0045]; EX1028, 4:8–12; EX1035, ¶ 39.

Brandmeier (EX1031) discloses a sensor device housing designed to be mounted a surface of a motor vehicle, and provides evidence that rigid sensor device housings and their benefits were known in the art. EX1031, (57) Abstract, ¶ [0027], claims 11–12; EX1035, ¶ 40. Armitage, LeFebvre, Barone, Moretti, and Brandmeier are therefore analogous art, and PHOSITA would have been motivated to combine their teachings for the reasons discussed below. EX1035, ¶ 41.

1. Claim 34

Ground 1: Most limitations of claim 34, including all limitations present in original claim 2, are disclosed by Armitage. *See* Paper No. 10, Corrected Petition for *Inter Partes* Review (“Corr. Pet.”), 56–64; EX1003, ¶¶ 251–275; EX1035, ¶ 42.

Ground 2: Most limitations of claim 34, including all limitations present in original claim 2, are disclosed by LeFebvre. *See* Corr. Pet., 19–27; EX1003, ¶¶ 74–106; EX1035, ¶ 44. The new limitations of claim 34, which were not previously addressed in this proceeding with respect to claim 2, are discussed in detail below.

- i. Limitations 34(a), (d), and (g): “mounted to a sidewall of a bearing adapter,” “parameters or conditions of a bearing,” “consisting of the bearing adapter,” “wherein information regarding the temperature being monitored comprises data representing a condition of the bearing”

Ground 1: It would have been obvious to mount Armitage’s sensor node to the sidewall of a bearing adapter. Armitage discloses that its sensor nodes are “attached or coupled to the associated undercarriage element,” which may be a “bearing or bearing box,” and can include a variety of sensor types including “thermometers” and “accelerometers.” EX1006, ¶¶ [0013]–[0015]. The sensor node is preferably attached to a “non-rotating structure,” such as a “bearing mount.” *Id.*, ¶ [0034]. While Armitage does not expressly identify the *sidewall* of the bearing adapter, a PHOSITA would have understood that both thermometers and accelerometers can be mounted to the sidewall of a bearing adapter to measure heat and vibrations, respectively, emanating from the bearing. EX1035, ¶¶ 45–46. For example, Barone discloses a sensor node mounted on the sidewall of a bearing adapter as required by the substitute claims. EX1007, ¶¶ [0289]–[0293], Figs. 11–13. A PHOSITA would have been motivated to mount a sensor node on the

sidewall of a bearing adapter because it is an easily accessible, non-rotating surface that transmits heat and vibrations emanating from the bearing. EX1035, ¶ 47.

Ground 2: LeFebvre’s sensor unit can include one or more temperature sensors to monitor bearing temperature. EX1005, (57) Abstract, ¶¶ [0021], [0033], [0058]; EX1003, ¶ 79. LeFebvre’s unit can also include a load sensor to “monitor vibrations emitted from the bearing (transmitted through the roller bearing adapter).” EX1005, ¶ [0059]. Although LeFebvre’s preferred embodiment is mounted on the upper surface of the bearing adapter, a PHOSITA would have understood that the shape, size, or location of the housing could be changed (e.g., to accommodate mounting a sensor device in a different location on the railcar) without affecting the operation of the sensors or electronic circuitry contained within the housing. EX1035, ¶ 48. For example, a PHOSITA could have modified LeFebvre’s device to extend along the sidewall of the bearing adapter at the location identified by Barone. EX1007, ¶¶ [0289]–[0293], Figs. 11–13; EX1035, ¶ 49. A PHOSITA would have been motivated to place a sensor node on the sidewall of the adapter because it is an easily accessible, non-rotating surface that transmits both heat and vibrations emanating from the bearing. EX1035, ¶ 49.

- ii. Limitation 34(b): “a housing comprising a non-flexible material that is resistant to environmental damage”

Grounds 1 and 2: It would have been obvious to incorporate a “non-flexible

material that is resistant to environmental damage” into a housing that protects the sensitive electronic components utilized by LeFebvre’s and Armitage’s monitoring systems. Rigid, durable materials, including plastics and metals, have been used to protect sensitive electronic components for as long as electronic components have existed. EX1035, ¶¶ 50–51. Brandmeier provides an example that illustrates this well-known concept: a sensor device housing made from a rigid, durable material that is designed to be mounted on a surface of a motor vehicle. EX1031, (57) Abstract, ¶ [0027], claims 11–12; EX1035, ¶ 50. It would have been obvious to construct the housing of Armitage’s sensor device from a rigid, durable material in order to protect the components within. EX1035, ¶ 51. Similarly, if LeFebvre’s sensor device were modified or extended to include a portion attached to the sidewall of the bearing adapter (see Section III.A.1.i, *supra*), it would have been obvious to construct at least that portion of the housing from a rigid, durable material to protect the sensors and electronics from the elements. EX1035, ¶ 51.

iii. Limitation 34(h): “a land-based remote station”

Ground 1: Armitage discloses that the control node on each railcar (i.e., a CMU) wirelessly transmits information, such as sensor data and alarm messages, to a collection node in a remote (i.e., off-train, land-based) location. EX1006, ¶¶ [0019], [0039]; EX1035, ¶ 52; *see also* Corr. Pet., 25–27, 40–41. Ground 2: LeFebvre discloses that its data control unit may communicate with a remote (off-

train, land-based) base unit via, for example, “a cellular or satellite radio system.”

EX1005, ¶¶ [0025], [0038], [0052]; EX1035, ¶ 53; *see also* Corr. Pet., 67–68.

- iv. Limitation 34(h): “correlate one or more numeric values derived from the data to the condition of the bearing”

Ground 1: Armitage discloses a sensor node that measures bearing temperature and is preferably attached to a “non-rotating structure,” such as a bearing mount. *See* EX1006, ¶ [0034]. A PHOSITA would understand that measuring bearing temperature indirectly—Armitage’s preferred embodiment—requires **correlating** the measured temperature of the bearing adapter with the inferred temperature of the bearing. EX1035, ¶ 54. As explained in the Petition, Armitage performs calculations on collected data that result in “numeric values” which represent the operational state of the bearing. EX1006, ¶¶ [0029], [0030] (using “moving average and trend analysis” to detect “statistically significant deviations”), [0045] (calculating averages, minimums, and maximums); EX1035, ¶ 54. *See also* Corr. Pet., 56–66; EX1003, ¶¶ 251–281.

Ground 2: LeFebvre’s instrumented pad **16** measures the temperature of wheel bearing adapter **4**, which can be used to infer the temperature of wheel bearing **2a**. EX1005, ¶ [0019], Fig. 4. *See* Petition, 28–29. In other words, LeFebvre’s system **correlates** the measured temperature of the bearing adapter with the inferred temperature of the bearing. EX1035, ¶ 55. Like Armitage,

LeFebvre also performs calculations that result in “numeric values” which represent the operational state of the bearing. EX1005, claim 9 (“*values* indicative of critical departures of the performance criteria”), claim 12 (“*values* derived by said sensors”); EX1035, ¶ 55; Corr. Pet., 19–27; EX1003, ¶¶ 74–106.

v. Limitation 34(h): “determine a severity of the condition of the bearing”

Grounds 1 and 2: As discussed at length in the Petition, all three of Armitage, LeFebvre, and Barone disclose using collected data to infer the well-being of a bearing and determine the severity of any detected problem or defect. EX1005, ¶¶ [0036], [0055]–[0056], [0058]–[0059]; EX1006, ¶¶ [0042]–[0044] (“The degree to which any specific sensor deviates from this population is indicative of the severity of the mechanical condition of the component.”); EX1007, ¶¶ [0201]–[0220]. If a sufficiently severe problem is detected, all three references disclose raising an alarm to alert a human operator to take an appropriate action. EX1005, ¶¶ [0038], [0052]; EX1006, ¶ [0028]; EX1007, ¶ [0036]; EX1003, ¶¶ 51, 54. *See also* EX1035, ¶¶ 56–57.

Armitage expressly uses a color-coded system to indicate the severity of a detected problem condition. EX1006, ¶ [0044] (“The event ranking could include a ‘yellow’ condition which indicates that a railway car requires service, and a ‘red’ condition which indicates that a sensor has detected a serious deviation...that requires immediate service.”). LeFebvre similarly discloses the use of bearing

temperature “alarm levels,” to infer the severity of a problem, EX1005, ¶ [0058], and the Martin Declaration admits that standard temperature thresholds for bearings were known in the art. EX2160, ¶ 23 (“The temperature thresholds that we were using during this project was roughly the same as industry standard thresholds used for analyzing train bearings.”); EX1035, ¶ 58.

More generally, a PHOSITA would have understood that a large deviation from expected operating conditions indicates a potentially serious underlying problem, while a small deviation from expected conditions indicates a smaller, less serious issue. EX1035, ¶¶ 56, 59.

- vi. Limitation 34(h): “determine an alarm condition based on the severity of the condition of the bearing, wherein said alarm condition comprises one or more recommended actions to be taken with respect to the bearing”

Grounds 1 and 2: A PHOSITA would have understood that the appropriate response to a problem on a vehicle depends on the severity of the underlying problem. EX1035, ¶ 60. For example, alerts that include recommended corrective actions are commonplace on modern automobiles. EX1038, 2:7–18 (“For example, if the oil pressure drops below some predetermined level, the driver is warned to stop his vehicle immediately.”); EX1036, 17:8–16 (“For example, a lower severity diagnostic result might be accompanied by a notification of the problem and a link to more information, whereas a higher severity diagnostic result might be accompanied by a stronger warning and a link to a dealer to schedule servicing.”).

See also EX1037, claim 2; EX1035, ¶ 61. In the context of railcar monitoring, Armitage describes a “railway car health scorecard,” which recommends a course of action based on the level of the alarm that is raised. EX1006, ¶ [0044]; EX1003, ¶ 280. Barone discloses a system that prompts a human to take appropriate action when a problem is detected. EX1007, ¶ [0036] (“If the estimated time to bearing failure permits, a maintenance action can be scheduled. If failure is estimated to be imminent, the train can be diverted or stopped before catastrophic bearing failure and derailment.”), ¶ [0164], ¶ [0191] (The system “generates an appropriate alarm or indication to prompt a human user to take remedial action.”). *See also* EX1024, 8:46–57. A PHOSITA would therefore have been motivated to send alarms that indicate both the severity of the underlying condition and the appropriate corrective action, because some conditions warrant immediate, urgent action (e.g., stopping the train) to avoid serious damage or injury—while other, less urgent conditions can be addressed by scheduling routine maintenance. EX1035, ¶ 62.

2. Claims 35–41

Ground 1: The limitations added by dependent claims 35–41, which correspond to original claims 3, 4, and 26–30 respectively, are disclosed by Armitage in view of LeFebvre. *See* Corr. Pet., 64–70, 73; EX1003, ¶¶ 276–281, 329–343, 363–365; EX1035, ¶ 63. Ground 2: The limitations added by dependent claims 35–41 are disclosed by LeFebvre. *See* Corr. Pet., 27–29, 39–41; EX1003,

¶¶ 107–115, 172–186; EX1035, ¶ 64.

3. Claim 42

Ground 1: Most limitations of claim 42, including all limitations present in original claim 5, are disclosed by Armitage in view of LeFebvre. *See* Corr. Pet., 74–75; EX1003, ¶¶ 282–293; EX1035, ¶ 65. Ground 2: Most limitations of claim 42, including all limitations present in original claim 5, are disclosed by LeFebvre. *See* Corr. Pet., 30–32; EX1003, ¶¶ 116–137; EX1035, ¶ 66. The new limitations of claim 42 are addressed below.

i. Limitation 42(a): “mounted to a sidewall of a bearing adapter”

See Section III.A.1.i, *supra*.

ii. Limitation 42(g)

See Sections III.A.1.iv and III.A.1.v, *supra*. Additionally, as explained in the Petition, both Armitage and LeFebvre disclose calculating numeric values based on collected data at the sensor node. For Armitage, *see* Corr. Pet., 60–61, 74 (citing EX1006, ¶¶ [0014], [0053], [0055], Figs. 3, 6); EX1003, ¶¶ 263–264, 287–288. For LeFebvre, *see* Corr. Pet., 36 (citing EX1005, ¶ [0053]); EX1003, ¶¶ 155–156.

iii. Limitation 42(k) and 42(l)

See Sections III.A.1.iii, III.A.1.iv, III.A.1.v, and III.A.1.vi, *supra*.

4. Claims 43–58

Ground 1: The limitations added by dependent claims 43–58, which

correspond to original claims 6–10, 13–18, 20–22, and 31–32 respectively, are disclosed by Armitage in view of LeFebvre. *See* Corr. Pet., 70–72, 75–84; EX1003, ¶¶ 294–338, 344–354; EX1035, ¶ 71. Ground 2: The limitations added by dependent claims 35–41 are disclosed by LeFebvre in view of Barone. *See* Corr. Pet., 32–38, 41, 43–50; EX1003, ¶¶ 139–159, 187, 188, 193–223; EX1035, ¶ 72.

New Limitations: With respect to claims 45 and 46, there is nothing inventive about using an accelerometer to measure vibrations emanating from a wheel bearing. It was known as early as the 1980s that “vibrations of bearing boxes change their nature when faults arise.” EX1029, 3:17–19; EX1035, ¶ 73. As discussed above, Armitage and LeFebvre each disclose sensor nodes that include accelerometers. *See* Section III.A.1.i, *supra*; EX1006, ¶¶ [0013]–[0015], [0025], [0027]; EX1005, claims 12, 21; Barone also discloses an accelerometer mounted on the sidewall of a bearing adapter, EX1007, ¶¶ [0045], [0289]–[0293], Figs. 11–13, and Moretti teaches that it is preferable to mount a vibration sensor on the bearing box wall “at a position vertically aligned with the axis of rotation of the bearing, where the vibrations are more intense.” EX1028, 3:22–28; EX1035, ¶ 73. With respect to claim 48, *see* Section III.A.1, *supra*.

B. Grounds 3 and 4: Claims 33, 59–61

As discussed in the Petition, a PHOSITA would have found it obvious to combine the disclosures of Armitage, LeFebvre, Denny, and Provasnik. *See* Corr.

Pet., 52–55, 84–86; EX1003, ¶¶ 228–230; EX1035, ¶ 74. All four references are directed to devices for monitoring the temperature of metallic mechanical components—specifically, wheel bearings (Armitage, LeFebvre, and Denny) and engines (Provasnik). Culbertson (EX1032) discloses a temperature sensing probe that is suitable for use in harsh environments including, for example, high vibration and temperature. EX1032, (57) Abstract, 10:37–56; EX1035, ¶ 75. A PHOSITA would have understood that Culbertson’s temperature sensing probe is suitable for monitoring railcar bearings as disclosed by LeFebvre and Armitage, and would have been motivated to combine these references as further discussed below. *Id.*

1. Claim 33

Ground 3: Most limitations of claim 33, including all limitations present in original claim 1, are disclosed by Armitage in view of LeFebvre, Denny, and Provasnik. *See* Corr. Pet., 84–86; EX1003, ¶¶ 228–245; EX1035, ¶ 77. Ground 4: Most limitations of claim 33, including all limitations present in original claim 1, are disclosed by LeFebvre in view of Denny and Provasnik. *See* Corr. Pet., 52–55; EX1003, ¶¶ 367–379; EX1035, ¶ 78. New limitations of claim 33 not previously addressed in this proceeding with respect to claim 1 are discussed in detail below.

Both Armitage and LeFebvre disclose the use of temperature sensors. Neither reference, however, expressly discloses a temperature sensor that is external to the housing. However, there are only two possible locations for a

temperature sensor—inside the housing, or outside the housing—and both options have advantages that would have been fully understood by a PHOSITA. EX1035, ¶ 80. For example, a PHOSITA would have understood that it is advantageous to locate a temperature sensor close to the part of the railcar whose temperature is to be measured. EX1035, ¶ 81. Additionally, a PHOSITA would have understood that sensitive electronic components should not be exposed to high temperatures, and that it is thus advantageous to place a temperature sensor outside the housing. *Id.*

For example, Denny (EX1008) states that “[i]n order to obtain an accurate high temperature reading of a wheel assembly, the temperature sensor ... should, preferably, extend deep into the wheel assembly.” EX1008, 2:24–27. Conversely, Denny explains that its sensor housing 12, which includes electronic circuitry, “is situated away from the outer surface of the wheel assembly so that the electronic circuit will not be subjected to heat from the wheel assembly and may freely dissipate heat produced by its own components.” EX1008, (57) Abstract. A PHOSITA therefore would have been motivated to equip the sensor device of Armitage or LeFebvre with an external temperature sensor to obtain an accurate measurement of bearing temperature. EX1035, ¶ 82.

Limitations 33(a) and 33(e)(i): Culbertson discloses an external temperature sensor that is suitable for use in harsh environments including, for example, high vibration and temperature. EX1032, (57) Abstract, 10:37–56; EX1035, ¶ 83.

Specifically, Culbertson discloses an assembly comprising a temperature probe **12** that is located external to a housing **28**. EX1032, Fig. 1, 4:13–35; EX1035, ¶ 84.

Culbertson’s housing **28** also includes an output portion **30** for coupling to a temperature measurement system., EX1032, 4:29–31, 5:1–9. 5:19–53; EX1035, ¶ 85. Accordingly, and as explained in further detail below, a PHOSITA could incorporate Culbertson’s external temperature sensor into the system of LeFebvre or Armitage with a reasonable expectation of success. EX1035, ¶ 85.

Limitation 33(e)(ii): The temperature probe **12** (i.e., a sensor probe head), has a probe body **16** formed of a heat conductive material, for example a mineral insulated cable comprising one or more conductors. EX1032, 4:15–18, 4:36–45; EX1035, ¶ 86. Alternatively, probe body **16** may be formed from a metal tube **94**. EX1032, 11:52–63, Fig. 5. The distal end of probe **12** also has a tip cap **14** that is preferably formed of a metal alloy (a heat conductive material). EX1032, 4:15–18.

Limitation 33(e)(iii): A pair of lead wires **26** each have a proximal end disposed within the housing **28** and a distal end that leads to probe **12**, external to the housing. EX1032, Fig. 1, 4:13–35. A transition component **22** comprises connectors that terminate conductors of the temperature probe **12** to the distal end of lead wires **26**. *Id.* at 4:21–28. The housing **28** includes an input portion **36** for receiving the proximal end of lead wires **26**. *Id.* at 5:1–2. EX1035, ¶ 87.

Limitation 33(e)(iv): Culbertson does not expressly disclose a magnetic

attachment. However, a PHOSITA would have been motivated to utilize a magnetic attachment as required by Limitation 33(e) and could have done so with a reasonable expectation of success. As shown in Fig. 1, Culbertson discloses a sensor probe head—temperature probe **12**—that includes a tip cap **14** at its distal end, a probe body **16**, a collar **20**, a mounting connector **18**, and a proximal end **24**. EX1032, 4:13–28; EX1035, ¶ 88. Culbertson teaches that probe body **16** can be formed from a metal tube **94**, and “can be formed, bent, or otherwise arranged for mounting on the desired temperature sensing application.” EX1032, 11:52–66.

A PHOSITA would have understood that a magnet could be used to attach Culbertson’s temperature probe to a metallic substrate. EX1035, ¶ 89. Provasnik identifies one obvious advantage of a magnet: it permits a sensor to be readily attached to, and removed from, a metallic substrate. EX1009, 1:8–15, 1:38–44, 4:65–68; EX1035, ¶ 89. Here, a PHOSITA would have understood that placing a magnet inside probe body **16** (i.e., inside metal tube **94**) would allow the sensor probe head to sit flush against a metal surface to be measured. Additionally, placing a magnet within proximal end **24** of the probe body **16** would be useful to minimize the vibration or movement of the adjacent transition component **22** and prevent the electrical connectors from becoming detached. EX1035, ¶ 89.

The cited references, in view of the general knowledge possessed by a PHOSITA, therefore render obvious every element of claim 33.

2. Claim 59

Ground 3: Most limitations of claim 59, including all limitations present in original claim 23, are disclosed by Armitage in view of LeFebvre. *See* Corr. Pet., 72–73; EX1003, ¶¶ 355–362; EX1035, ¶ 91. Ground 4: Most limitations of claim 59, including all limitations present in original claim 23, are disclosed by LeFebvre. *See* Corr. Pet., 38; EX1003, ¶¶ 161–170; EX1035, ¶ 92. Grounds 3 and 4: The new limitations of claim 59 are substantially the same as the limitations of claim 33, and are obvious for the same reasons. *See* Section III.B.1, *supra*.

3. Claims 60–61

Ground 3: The limitations added by dependent claim 60 are obvious over Armitage in view of LeFebvre, Denny, and Provasnik, and limitations added by dependent claim 61 are obvious over Armitage in view of LeFebvre. *See* Corr. Pet., 73, 86; EX1003, ¶¶ 363, 380; EX1035, ¶ 94. Ground 4: The limitations added by dependent claim 60 are obvious over LeFebvre in view of Denny and Provasnik, and the limitations added by dependent claim 61 are obvious over LeFebvre. *See* Corr. Pet., 50–51, 55; EX1003, ¶¶ 225–227, 246; EX1035, ¶ 95.

IV. CONCLUSION

Petitioner respectfully requests that the Board deny the Revised Motion to Amend.

Case No. IPR2023-00538
Patent No. 9,365,223

Respectfully submitted,

Dated: April 19, 2024

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CERTIFICATE OF SERVICE

I hereby certify that on this 19th day of April, 2024, the foregoing was served via electronic mail to the attorneys of record for the '223 Patent at the following address:

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LISTING OF CLAIMS

Claim Limitation	Claim Language
Claim 33 Preamble	A sensor device for monitoring temperature on a railcar, comprising:
Limitation 33(a)	a housing <u>providing a first piece mountable</u> on a railcar;
Limitation 33(b)	a temperature sensor;
Limitation 33(c)	electrical circuitry in communication with said temperature sensor <u>via a cable</u> for obtaining information regarding the temperature being sensed, <u>wherein said electrical circuitry is positioned within said housing, and said cable has a proximal end disposed in the housing and a distal end residing external to said housing;</u>
Limitation 33(d)	a power source electrically connected to said electrical circuitry <u>to</u> [[for]] provide[[ing]] power thereto, said power source positioned within said housing;
Limitation 33(e)	a probe <u>providing a second piece external to and separated from the first piece provided by said housing, said second piece and which probe comprising a sensor probe head that (i) is spaced apart from the housing, (ii) has a body formed of a heat conductive material, (iii) has a connector electrically interfaced with said temperature sensor and configured to connect to a corresponding electrical connector at the distal end of the cable and includes said temperature sensor, and (iv) has a magnet positioned in the body adjacent to a portion of the connector extending inside the body, the magnet configured to magnetically attract the part of the railcar against which the sensor probe head will be placed; and</u>
Limitation 33(f)	a communication device <u>configured to</u> ~~capable of~~ broadcast[[ing]] information regarding the temperature sensed, said communication device positioned within said housing;
Limitation 33(g)	wherein the power consumption of said sensor device is managed by placing said sensor device in a standby state and periodically awakening said sensor device to collect readings from said temperature sensor and to transmit the information regarding the temperature sensed via said communication

Claim Limitation	Claim Language
	~~device circuitry.~~
Claim 34 Preamble	A system for monitoring a railcar, comprising:
Limitation 34(a)	a plurality of sensor devices <u>each located on and mounted to a sidewall of a bearing adapter of the railcar</u> for monitoring parameters or conditions <u>of a bearing of the railcar</u> , each of said sensor devices being separate from one another and including a sensor for monitoring one of said parameters or conditions <u>of the bearing of the railcar</u> ;
Limitation 34(b)	said plurality of sensor devices including at least one temperature sensor device having:
Limitation 34(c)	a housing <u>comprising a non-flexible material that is resistant to environmental damage</u> ;
Limitation 34(d)	a temperature sensor in thermal communication with an item <u>consisting of the bearing adapter of the railcar</u> for which the temperature is being monitored, which item is external to said housing;
Limitation 34(e)	electrical circuitry in communication with said temperature sensor for obtaining information regarding the temperature being ~~sensed~~ <u>monitored</u> , said electrical circuitry positioned within said housing;
Limitation 34(f)	a power source electrically connected to said electrical circuitry for providing power thereto, said power source positioned within said housing;
Limitation 34(g)	a communication device capable of broadcasting information regarding the temperature <u>being monitored</u> ~~sensed~~ via wireless communication, said communication device positioned within said housing, <u>wherein said information regarding the temperature being monitored comprises data representing a condition of a bearing</u> ; and
Limitation 34(h)	a communication management unit, mounted on the railcar, capable of two way wireless communication with each of said plurality of sensor devices for receiving information therefrom, said communication management unit having a wireless communication device for broadcasting information about the parameter or condition being monitored <u>to a land-based remote station</u> ,

Claim Limitation	Claim Language
Limitation 34(g)	<u>wherein at least one of the communication management unit or the remote station is configured to (i) correlate one or more numeric values derived from the data to the condition of the bearing, (ii) determine a severity of a condition of the bearing, and (iii) determine an alarm condition based on the severity of the condition of the bearing, wherein said alarm condition comprises one or more recommended actions to be taken with respect to the bearing.</u>
Claim 35	The system of ~~claim 2~~ <u>claim 34</u> , wherein said communication management unit can make a determination of an alarm condition based on data collected by two or more of said sensor devices.
Claim 36	The system of ~~claim 2~~ <u>claim 34</u> , wherein each of said plurality of sensor devices is capable of exchanging data with other of said plurality of sensor devices and with said communication management unit.
Claim 37	The system of ~~claim 2~~ <u>claim 34</u> , wherein said communication management unit applies heuristics to analyze data collected from said ~~one or more~~ <u>plurality of</u> sensor devices (a) to determine if an actual failure exists and (b) to predict potential or imminent failures based on a statistical analysis of said collected data.
Claim 38	The system of ~~claim 2~~ <u>claim 34</u> , further comprising a second temperature sensor located on said railcar for measuring ambient air temperature, wherein said system uses information obtained from said second temperature sensor about the ambient temperature to calibrate the temperature data received from said first sensor regarding the item of the railcar being monitored.
Claim 39	The system of ~~claim 2~~ <u>claim 34</u> , wherein said communicating management unit is capable of communicating data and alarms to a remote location located off of the train of which

Claim Limitation	Claim Language
	the railcar is a part.
Claim 40	The system of ~~claim 2~~ <u>claim 34</u> , wherein the power consumption of each of said sensor devices is managed by placing each said sensor device in a standby state and periodically awakening said sensor device to collect readings from said sensor device and to transmit the information regarding the parameter or condition being sensed via said communication circuitry.
Claim 41	The system of ~~claim 2-claim 34~~ , wherein said communication management unit and said plurality of sensor devices form a wireless mesh network for said railcar.
Claim 42 Preamble	A system for monitoring the operation of a railcar comprising:
Limitation 42(a)	a. one or more sensor units mounted <u>to a sidewall of a bearing adapter</u> on said railcar, each of said sensor units monitoring an operating parameter of said railcar wherein each of said sensor units comprises
Limitation 42(b)	a sensor,
Limitation 42(c)	a power source,
Limitation 42(d)	a processor,
Limitation 42(e)	memory,
Limitation 42(f)	communications circuitry, and
Limitation 42(g)	software, stored in said memory and executed by said processor, said software performing the functions of collecting data from said sensor at periodic intervals <u>and calculating one or more numeric values based on the collected data, wherein the one or more numeric values represent a condition of a bearing</u> ; and
Limitation 42(h)	b. a communication management unit, mounted on said railcar, said communication management unit in wireless communication with said one or more sensor units;
Limitation 42(i)	wherein said communication management unit applies heuristics to analyze data collected from said one or more sensor units

Claim Limitation	Claim Language
Limitation 42(j)	(a) to determine if an actual failure exists and
Limitation 42(k)	(b) to predict potential or imminent failures based on a statistical analysis of said collected data <u>by correlating one or more numeric values derived from the data to the condition of the bearing and determining a severity of the condition of the bearing;</u>
Limitation 42(l)	c. <u>a land-based remote base unit, in wireless communication with said communication management unit, configured to:</u> <u>(i) receive data from said communication management unit;</u> <u>(ii) determine a severity of the condition of the bearing based on the data received from the communication management unit;</u> <u>(iii) determine an alarm condition based on the severity of the condition of the bearing, wherein said alarm condition comprises a recommended action with respect to the bearing.</u>
Claim 43	The system of ~~claim 5~~ <u>claim 42</u> , wherein said determination of an alarm condition can be made by one of said sensor units.
Claim 44	The system of ~~claim 5~~ <u>claim 42</u> , wherein said determination of an alarm condition can be made by said communication management unit based on data collected by two or more of said sensor units.
Claim 45	The system of ~~claim 5~~ <u>claim 42</u> , wherein ~~each of~~ said sensor ~~units~~ comprises: <u>a. a vibration sensor or accelerometer configured to sample dynamic vibration data; and</u> <u>b. a power source;</u> <u>c. a processor;</u> <u>d. memory;</u> <u>e. communications circuitry; and</u> <u>f. wherein software, stored in said memory and executed by said processor, said software further performs performing the functions of collecting sampled dynamic vibration data from said sensor at periodic intervals, wherein the one or more</u>

Claim Limitation	Claim Language
	<u>numeric values is calculated from the sampled dynamic vibration data, and wherein the severity of the condition of the bearing is determined based on the one or more numeric values.</u>
Claim 46	The system of ~~claim 8~~ <u>claim 45</u> , wherein said software further performs the function of: assessing the ~~collected~~ <u>sampled dynamic vibration</u> data to determine if an alarm condition exists; ~~and~~ communicating said alarm condition to said communication management unit via said communications circuitry; and managing the power consumption of said sensor unit by placing said sensor unit in a standby state and periodically awakening said sensor unit to collect data from said sensor and to transmit information regarding said operating parameter to said communication management unit via said <u>communications circuitry</u> .
Claim 47	The system of ~~claim 5~~ <u>claim 42</u> , wherein said one or more sensor units and said communication management unit are in wireless communication with each other and form a local area wireless network for said railcar.
Limitation 48(a)	The system of ~~claim 5~~ <u>claim 42</u> , ~~further comprising a~~ <u>wherein said land-based remote base unit is further configured to,</u> ~~said base unit being in wireless communication with said communication management unit,~~ <u>said based unit performing the functions of:</u>
Limitation 48(b)	a. ~~collecting~~ <u>collect</u> data and alarms from said communication management unit;
Limitation 48(c)	b. ~~displaying~~ <u>display</u> one or more alarm conditions raised by said communication management unit, <u>said alarm conditions are based on the severity of the condition of the bearing and comprises a recommended action with respect to the bearing;</u> and
Limitation 48(d)	c. ~~determining~~ <u>determine</u> high level alarms based on data and alarms collected from said communication management unit

Claim Limitation	Claim Language
	<u>by comparing the one or more numeric values with a plurality of defined parameter value ranges associated with the bearing.</u>
Claim 49	The system of ~~claim 13~~ <u>claim 48</u> , wherein said base unit is in wireless communication with multiple communication management units.
Claim 50	The system of ~~claim 14~~ <u>claim 49</u> , wherein said base unit uses distributed event processing to perform trend analysis based on alarms and data collected from one or more communication management units to determine if a high level alarm should be raised.
Claim 51	The system of ~~claim 14~~ <u>claim 50</u> , wherein said base unit applies heuristics to data collected from said one or more communication management units to determine if a high level alarm should be raised.
Claim 52	The system of ~~claim 16~~ <u>claim 51</u> , wherein said base unit and said one or more communication management units communicate with each other via a satellite communications capability or a cellular network capability.
Claim 53	The system of ~~claim 5~~ <u>claim 42</u> , wherein said sensor is selected from a group consisting essentially of temperature sensors, pressure sensors, strain sensors, load cell sensors, hand brake position sensors, magnetic sensors, vibration sensors, gyroscopes, acceleration sensors, hall effect sensors, piezoelectric resistive microphones and switches.
Claim 54	The system of ~~claim 5~~ <u>claim 42</u> , wherein said alarm <u>condition</u> is determined using distributed event processing based on a comparison between current data and statistical models of behavior.
Claim 55	The system of ~~claim 5~~ <u>claim 42</u> , wherein said ~~alarms are~~

Claim Limitation	Claim Language
	<u>alarm condition is</u> determined based on a comparison of currently collected data versus data collected over a pre-determined preceding time period.
Claim 56	The system of ~~claim 5~~ <u>claim 42</u> , wherein an alarm is raised based one or more of the following criteria: a. a pre-determined percentage of current data readings exceeds allowable peak readings; b. a pre-determined percentage of current data readings exceeds a determined value; c. a pre-determined percentage of current data readings exceeds a standard deviation from readings from the same railcar; d. a pre-determined percentage of current data readings exceeds a standard deviation from all railcars in the fleet; or e. the rate of change of current data readings exceeds a pre-determined threshold
Claim 57	The system of ~~claim 5~~ <u>claim 42</u> , wherein the power consumption of each of said sensing units is managed by placing each sensing unit in a standby state and periodically awakening said sensing unit to collect readings from said sensor and to transmit information via said communications circuitry.
Claim 58	The system of ~~claim 5~~ <u>claim 42</u> , wherein said communication management unit is capable of communicating with a remote location located off of a train of which said railcar is a part.
Claim 59 Preamble	A monitoring device for monitoring temperature on a railcar, comprising:
Limitation 59(a)	A housing mountable on a railcar;
Limitation 59(b)	a temperature sensor configured to be in thermal communication with a portion of the railcar to be monitored for temperature, which portion is external to said housing, <u>the temperature sensor positioned within a probe head and</u>

Claim Limitation	Claim Language
	<u>interfaced with an electrical connector, the probe head configured to receive a cable having a corresponding electrical connector;</u>
Limitation 59(c)	electrical circuitry in communication with said temperature sensor <u>via the cable</u> for obtaining information regarding the temperature being sensed, said electrical circuitry positioned within said housing, <u>said electrical circuitry positioned within said housing, said cable having a proximal end disposed in the housing and a distal end residing external to said housing;</u>
Limitation 59(d)	a power source electrically connected to said electrical circuitry for providing power thereto, said power source positioned within said housing; and
Limitation 59(e)	a communication device capable broadcasting information regarding the temperature sensed, said communication device positioned within said housing;
Limitation 59(f)	wherein the power consumption of said monitoring device is managed by placing said monitoring device in a standby state and periodically awakening said monitoring device to collect readings from said temperature sensor and to transmit the information regarding the temperature sensed via said communication circuitry.
Claim 60	The monitoring device of ~~claim 23~~ <u>claim 59</u> , wherein at least a section of said temperature sensor is disposed outside of and spaced from said housing to be capable of contacting the surface of the railcar for which the temperature is to be monitored.
Claim 61	The monitoring device of ~~claim 23~~ <u>claim 59</u> , wherein said circuitry is configured to apply heuristics to analyze data collected from said temperature sensor to determine if a problem exists.